POINTS ON ELECTROCHEMISTRY - I

6. ELECTROCHEMISTY

1. Oxidation is defined as a loss of electrons while reduction is defined as a gain of electrons.

2. In a redox reaction, both oxidation and reduction reaction takes place simultaneously.

3. Direct redox reaction: In a direct redox reaction, both oxidation and reduction reactions take place in the same vessel. Chemical energy is converted to heat energy in a direct redox reaction.

4. Indirect redox reaction: In indirect redox reactions, oxidation and reduction take place in different vessels. In an indirect redox reaction, chemical energy is converted into electrical energy.

5. In an indirect redox reaction, the device which converts chemical energy into electrical energy is known as an electrochemical cell.

6. In an electrochemical cell:

a. The half cell in which oxidation takes place is known as oxidation half cell
b. The half cell in which reduction takes place is known as reduction half cell.
c. Oxidation takes place at anode which is negatively charged and reduction takes place at cathode which is positively charged.
d. Transfer of electrons takes place from anode to cathode while electric current flows in the opposite direction.
e. An electrode is made by dipping the metal plate into the electrolytic solution of its soluble salt.
f. A salt bridge is a U shaped tube containing an inert electrolyte in agar-agar and gelatine.

7. A salt bridge maintains electrical neutrality and allows the flow of electric current by completing the electrical circuit.

8. Representation of an electrochemical cell:

a. Anode is written on the left while the cathode is written on the right.
b. Anode represents the oxidation half cell and is written as:
Metal/Metal ion (Concentration)
c. Cathode represents the reduction half cell and is written as:
Metal ion (Concentration)/Metal
d. Salt bridge is indicated by placing double vertical lines between the anode and the cathode

e. Electrode potential is the potential difference that develops between the electrode and its electrolyte. The separation of charges at the equilibrium state results in the potential difference between the metal and the solution of its ions. It is the measure of tendency of an electrode in the half cell to lose or gain electrons.

9. When the concentration of all the species involved in a half cell is unity, then the electrode potential is known as standard electrode potential. It is denoted as $E^{\ominus}$.

10. According to the present convention, standard reduction potentials are now called standard electrode potential.

11. There are 2 types of electrode potentials: Oxidation potential and reduction potential.

12. Oxidation potential is the tendency of an electrode to lose electrons or get oxidized.

13. Reduction potential is the tendency of an electrode to gain electrons or get reduced.

14. Oxidation potential is the reverse of reduction potential.

15. The electrode having a higher reduction potential has a higher tendency to gain electrons. So, it acts as a cathode.

16. The electrode having a lower reduction potential acts as an anode.

17. The standard electrode potential of an electrode cannot be measured in isolation.

18. According to convention, the Standard Hydrogen Electrode is taken as a reference electrode and it is assigned a zero potential at all temperatures.

19. Standard calomel electrode can also be used as a reference electrode.

20. Standard hydrogen electrode consists of a platinum wire sealed in a glass tube and carrying a platinum foil at one end. The electrode is placed in a beaker containing an aqueous solution of an acid having 1 Molar concentration of hydrogen ions. Hydrogen gas at 1 bar pressure is continuously bubbled through the solution at 298 K. The oxidation or reduction takes place at the Platinum foil. The standard hydrogen electrode can act as both anode and cathode.
If the standard hydrogen electrode acts as an anode:
$H_2\ (g) \rightarrow 2H^+\ (aq) + 2e^-$
If the standard hydrogen electrode acts as a cathode:
$2H^+\ (aq) + 2e^- \rightarrow H_2\ (g)$